

f. 1.66 B
163
GBR
A
87 C60.
82 C60.
83 C60.
84 C60.
85 C60.
86 C60 in macroscopic measurable quantities.
88 C70.
89 C70.
90 C70.
91 carbon product comprising C60 and C70.
92 Crystalline C60.
93 Crystalline C70.
94 Substantially pure crystalline C60.
95 Substantially pure crystalline C70.

(c) soluble in non-polar solvents.

80. A formed or molded product comprising solid C₇₀.

81. A free-flowing particulate comprising solid C₇₀.

83. Solid C₆₀.

84. Substantially pure C₆₀.

85. Substantially pure solid C₆₀.

86. C₆₀ in *macroscopic* measurable quantities.

88. Solid C₇₀.

89. Substantially pure C₇₀.

90. Substantially pure solid C₇₀.

91. A carbon product comprising C₆₀ and C₇₀.

92. Crystalline C₆₀.

93. Crystalline C₇₀.

94. Substantially pure crystalline C₆₀.

95. Substantially pure crystalline C₇₀.

REMARKS

In the Office Action dated November 15, 1991, the Examiner has rejected Claims 15, 17-22, 26, 29 and 32 under 35 U.S.C. §112, second paragraph. The Examiner has rejected Claims 14, 16, 17 and 23-36 under 35 U.S.C. §102(b) as defining subject matter which is anticipated by Kroto, et al. in Nature, 1985, 318, 162-163 ("Kroto et al.") with the article by Curl, et al., Scientific American, 1991, 54 ("Curl et al.") which was cited to allegedly show an inherent state of fact. Finally, the Examiner has rejected Claims 14-25, 27-31 and 33-36 under 35 U.S.C. §102(b) or, in the alternative, under 35 U.S.C. §103 as defining subject matter which is allegedly anticipated or, in the alternative, rendered obvious by Kirk-Othmer, Encyclopedia of Chemical Technology, 1978, 4, 652-653 ("Kirk-Othmer") in view of Gerhardt et al., Chemical Physics Letters,

1987, 137, 306-310 ("Gerhardt et al"), an article by Howard, et al. in Nature, 1991, 352, 139-141 ("Howard, et al.") and Curl et al. In addition, the Examiner has made minor objections to the specification.

In response to the Office Action, applicants have amended the claims, which, when considered with the comments hereinbelow, is deemed to place the present case in condition of allowance. Favorable reconsideration is respectfully requested.

In the Office Action, the Examiner has maintained the Restriction Requirement and has made it Final. Applicants reiterate the arguments presented in the Response Under 37 C.F.R. §§1.111 and 1.143 dated October 11, 1991, which are incorporated by reference as if fully set forth hereinbelow. However, in order to advance the prosecution thereof, applicants have cancelled the non-elected claims. But, applicants reserve the right to file a divisional application directed to the non-elected subject matter. As the Examiner has indicated, claims directed to the non-elected subject matter in a divisional application would not be subject to a double patenting rejection.

Applicants also amended the specification to correct the informal objections in accordance with the Examiner's suggestions.

Applicants have rewritten the claims to more precisely define the subject matter therein. Support for the subject matter is shown in the following Table:

CLAIM	SUPPORT
45	Claim 14
46	Claims 14, 16, 28
47	Claim 28
48	Claim 14, Page 8, line 6-Page 11, line 26, Fig. 1, Fig. 2, Page 14, lines 14-28
49	Claims 14, 16, 28
50	Claim 15, Page 14, lines 14-28, Page 8, line 6-Page 11, line 16
51	Claim 28, Page 14, lines 14-28
52	Claim 17
53	Claim 18, Page 3, lines 26-35
54	Claim 18
55	Claim 18, Page 3, lines 26-35
56	Claim 18, Page 3, lines 26-35, Page 4, lines 1-10
57	Page 6, line 23 to Page 7, line 10
58	Claim 18, Page 4, lines 1-5
59	Page 16, lines 1-10
60	Page 4, lines 11-15
61	Claim 15
62	Claim 19
63	Claim 20
64	Page 5, lines 8-15
65	Page 4, lines 11-15, Claim 8
66	Page 5, line 30-Page 6, line 6
67	Claim 5
68	Claim 6
69	Page 6, lines 16-22
70	Page 6, lines 6-7
71	Page 13, line 32-Page 14-line 33
72	Page 13, line 32-Page 14-line 29
73	Claim 23, Page 14, lines 18-28
74	Claim 24
75	Claim 25

CLAIM		SUPPORT
CLAIM	SUPPORT	
76	Claim 27	
77	Claim 28	
78	Claim 28	
79	Claim 29	
80	Claim 30, Page 14, lines 14-28	
81	Claim 31, Page 14, lines 14-28	
82	Claim 33	
83	Page 14, lines 14-28	
84	Claim 26	
85	Claim 28, Page 14, lines 14-28	
86	Page 3, line 26-Page 5, line 28, Examples 1-3	
87	Claim 34	
88	Page 14, lines 14-28	
89	Claim 32	
90	Claim 32, Page 14, lines 14-28	
91	Page 6, lines 6-21, Page 14, lines 14-28, Claim 16	
92	Page 14, lines 14-28	
93	Page 14, lines 14-28	
94	Page 6, lines 6-21, Page 13, line 26 to Page 14, line 32, Claim 26	
95	Claim 32, Page 13, line 26 to Page 14, line 32	

In support of the rejection of Claims 15, 17-22, 26, 29 and 32 under 35 U.S.C. §112, second paragraph, the Examiner alleges that the subject matter in the claims fail to particularly point out and distinctly claim the subject matter which applicants regard as the invention. In particular, the Examiner alleges that "intense" in Claim 17 and "broad" in Claim 29 and "pure" and "substantially pure" in Claim 26 and 32 are indefinite. Further, the Examiner alleges that Claims 15 and 18-22 are indefinite, alleging they depend from non-

elected claims. The Examiner also objects to Claim 17 on informal matters.

Applicants have rewritten the product by process claims (Claims 53-72) without reference to the non-elected subject matter. Applicants have deleted the term "intense" from Claim 52 (corresponding to old Claim 17) and have corrected the spelling of sublimes therein. Furthermore, in Claim 79 (corresponding to old Claim 29) applicants have deleted the term "broad".

With respect to the Examiner's allegation that the terms "pure" and "substantially pure" are indefinite, applicants strongly disagree. The term "purity" is a term of art that is readily understood by one skilled in the art. In support thereof, applicants are submitting herewith page 871 from the "Condensed Chemical Dictionary", Tenth Edition, revised by Gessner G. Hawley 1981, in which the term "purity" is defined. As indicated in the definition, "purity exists when no impurity can be detected by any experimental procedure." Id. Thus, the term has definite meaning to the skilled artisan in the field.

Furthermore, it is well established that the term "substantially" is not indefinite as a matter of law. United States Phillips Corps. v. National Micronetics Inc., 410 F. Supp. 449, 445, 188 USPQ 662, 668 (S.D.N.Y. 1976); 2 PETER D. ROSENBERG PATENT LAW FUNDAMENTALS §14.06 [5][a] (1992). The term "substantially" as an element of the claim is one commonly used in patents to prevent the avoidance of literal infringement by minor changes which do not themselves cause a loss of the benefit of the patent. 1 A.W. DELLER, PATENT CLAIMS §305 (2d Ed. 1971). As the Court in Rosemont, Inc. v.

Beckman Instruments, Inc., 777 F.2d 1540, 1546-47, 221 USPQ 1, 7 (Fed. Cir. 1984) stated:

Beckman attacks the claim as indefinite, primarily because 'close proximity' is not specifically or precisely defined. As stated in the district court's Memorandum Decision, 'to accept Beckman's contention would turn the construction of a patent into a mere semantic quibble that serves no useful purpose.'

In the same way, the Examiner's contention regarding the alleged impression of "substantially pure" would also turn the construction of a patent into a mere semantic quibble that serves no useful purpose.

Furthermore, the criticized phraseology does not stand in a vacuum. In re Moore, 493 F.2d 1232, 169 USPQ 236 (CCPA 1971). The claims must be read in light of the specification. In re Cohn, 438 F.2d 989, 169 USPQ 95 (CCPA 1971). The specification teaches how to prepare C₆₀ and C₇₀ and purify the same. In this regard, the Examiner's attention is directed to Page 3, line 26 to Page 7, lines 25, Page 13, line 32, Page 14, line 34 and Examples 1 and 3 of the instant specification. Furthermore, the specification provides certain physical characteristics of examples of substantially pure C₆₀ and C₇₀, See, for example, Claims 17 and 29, and the description in the specification on Page 8, line 6 to Page 13, line 25. Furthermore, the presence or absence of these characteristics allows one skilled in the art to determine the relative purity of the sample. Further, the term is as precise as the subject matter permits:

[T]he claims read in light of the specification reasonably apprise those skilled in the art and are as precise as the subject matter permits. AS a matter of law, no court can demand more.

Hybritech Inc. v. Monoclonal Antibodies, Inc., 802 F.2d 1367, 1385, 231 USPQ 81, 95 (Fed. Cir. 1986).

Therefore, for the reasons given herein, the rejection of the claims under 35 U.S.C. §112, second paragraph, is overcome and withdrawal thereof is respectfully requested.

The Examiner rejects Claims 14, 16, 17 and 23-36 under 35 U.S.C. §102(b), as allegedly being anticipated by Kroto, et al. with Curl, et al. being cited to show an allegedly inherent state of fact.

The present invention is directed to various embodiments of C₆₀ and C₇₀. For example, it is directed to C₆₀, C₇₀, substantially pure C₆₀, substantially pure C₇₀, solid C₆₀, solid C₇₀, crystalline C₆₀, crystalline C₇₀, C₆₀ in appreciable amounts, combinations thereof and products (or solids) containing C₆₀ and C₇₀ solids, crystals, etc.

The Kroto et al., article describes the following experiment. A solid disk of graphite was vaporized into a high-density helium flow using a focused pulsed laser. The resulting vaporized carbon was expanded in a supersonic molecular beam and photoionized using an excimer laser, thereby forming molecular ions. The molecular ions, and not the molecule, were detected by time of flight mass spectrometry.

The Kroto, et al. article is a theoretical and speculative article respecting buckminsterfullerenes. Kroto, et al. do not have any direct evidence of C₆₀ and C₇₀. The Kroto, et al. article describes only one experiment and provides only one piece of indirect evidence on which they hang their hats. Thus, the conclusions therein are speculative. Furthermore, they never made solid C₆₀ or C₇₀; thus they never obtained or isolated any crystalline form thereof. Whatever it is they made, they never made it in any macroscopic amounts. They could not "see" what it was they

made. They did not have in their possession that which they made whatever it was that they made, for it was made on the molecular scale, in microscopic levels.

Moreover, Kroto, et al. never detected the C₆₀ and C₇₀ molecules, in those experiments; they only detected the molecular ions of something having a m/e of C₆₀ and C₇₀. By their own admission, Curl et al., (authors of which were listed as authors in Kroto, et al.) state that they did not have direct evidence of C₆₀ and C₇₀,

....[W]e could not collect more than a few tens of thousands of the special new molecules. This amount was plenty to detect and probe with the sophisticated techniques available in our laboratory, but there was not enough to see, touch or smell. Our evidence was indirect... For now, the fullerenes existed only as fleeting signals detected in our exotic machines... Id. at 54.

They were completely unsuccessful in making, isolating and collecting C₆₀ and C₇₀. They only had indirect evidence of what it is that they made. They never made solid C₆₀ and C₇₀. They never made or isolated a crystalline form of C₆₀ and C₇₀. As shown hereinbelow, it was only speculative as to what it was they had. Whatever they made, they only made it in non-measurable amounts. At best, they could only make molecules of something, only tens of thousands of molecules, which they could not touch, see or smell. No matter how much they tried, they were always unsuccessful in making more. They could never make enough material to put it in the possession of the public:

Thus, for five years, we had been searching for a method of producing visible amounts of the stuff. We called our efforts "the search for the vial" because quantum calculations for such a soccer ball shaped carbon molecule suggested it would absorb light strongly only in the far violet of the spectrum.... Curl, et al. at 55.

Furthermore, the preparation of the material in larger amounts was not trivial; other scientists in the field were also unsuccessful:

...We were not alone. Our initial "soccer ball" proposal published in Nature in 1985 had made the quest one of the hottest in chemistry.

In our laboratory we collected the sooty carbon produced by the vaporization laser while using various chemical techniques to detect the present of C₆₀. We slurried the soot in benzene, for example, and looked for a yellow color. But, the solution in our test tubes stayed clear, with boring black soot sitting on the bottom. The community of cluster chemists ran many more sophisticated experiments but achieved no better result.

Many gave up hope of ever seeing the yellow vial. They reasoned that although the fullerenes may be stable, it was too hard to separate them from the other sooty material being produced in the vaporization experiments. Perhaps, the workers said some dedicated chemist might one day extract a few micrograms with some special solvent, but no one seriously expected C₆₀ to be available in bulk anytime soon. Id. at 55-56.

The Kroto et al. article is improperly cited as a reference. It is non-enabling. To be enabling, a reference must describe an invention sufficiently to have placed the public in possession of it. In re Donahue, 766 F.2d 531, 226, USPQ 619 (Fed. Cir. 1985). The printed publication must be enabling. Constant v. Advanced Micro-Devices, Inc., 848 F.2d 1560, 7 USPQ 2d 1057 (Fed. Cir. 1988).

But, the public was not possessed of a method of preparing, isolating, and collecting C₆₀ and C₇₀, especially a C₆₀ or C₇₀ in the solid state. Based on the teachings by Kroto, et al., people skilled in the art were unsuccessful in preparing macroscopic quantities of C₆₀ or C₇₀. Despite extensive efforts, no solid of C₆₀ or C₇₀ could be made or isolated until these were prepared and isolated by the present inventors. Furthermore, despite the extensive efforts, no

crystalline C₆₀ or C₇₀ was ever prepared and isolated until the advent of the present inventors. Further, no material containing solids comprising C₆₀ and/or C₇₀ were made until the present inventors developed the methodology. Thus, Kroto, et al. did not place the public in possession of the applicants' invention.

It is well settled that prior art under 35 U.S.C. §102(b) must sufficiently describe the claimed invention to have place the public in possession of it.... Such possession is effected if one of ordinary skill in the art could have combined the publication's description of the invention with his own knowledge to make the claimed invention. Accordingly, even if the claimed invention is disclosed in a printed publication, that disclosure will not suffice as prior art if it was not enabling... In re Donahue, 766 F.2d 531, 533, 226 USPQ 619, 621 (Fed. Cir. 1985).

However, the Court continues that if the reference teaches that attempts to make the invention failed, as in the present case, the reference is non-enabling:

...In those cases, the references were deemed insufficient because they stated that attempts to prepare the claimed compounds were unsuccessful. Such failures by those skilled in the art (having possession of the information disclosed by the publication) are strong evidence that the disclosure of the publication was non-enabling. Id.

Moreover, prior to the filing date of present invention, it was mere speculation by Kroto, et al. that they generated any C₆₀ or C₇₀. Kroto, et al. did not have any direct evidence of the preparation of any C₆₀ or C₇₀. Contrary to the allegations of the Examiner, they only detected molecular ions having the same m/e value as C₆₀ molecular ion (or C₇₀ molecular ion). They never directly detected any C₆₀ or C₇₀. Thus, at the time, they could not be certain that they made C₆₀ or C₇₀. For example, the molecular ion may have not necessarily corresponded to the parent ion,

it might have corresponded to a break down of a larger molecule caused by the ionization. Thus, the parent ion may not have been detected. This phenomenon does occur in samples ionized in mass spectrophotometers. Furthermore, there is additional evidence that Kroto, et al. did not produce any C₆₀. If C₆₀ were present in the soot, then when slurried with benzene, they would have obtained a colored solution. But, when they slurried the soot with benzene, they were always unsuccessful in obtaining a colored solution. See Curl, et al. p55. Thus, there was conflicting data to whether Kroto, et al., had C₆₀ and C₇₀ at that time. Thus, at that time the hypothesis of the existence of C₆₀ and C₇₀ was pure speculation. Consequently, the Kroto, et al. article, did not provide anything more than just a listing of C₆₀ and C₇₀:

[L]isting of the compounds by name constituted nothing more than speculation about their potential or theoretical existence. The mere naming of a compound in a reference, without more, cannot constitute a description of the compound, particularly when, as in the case, the evidence of record suggests that a method suitable for its preparation was not developed...until a date later than that of the reference.

If we were to hold otherwise, lists of thousands of theoretically possible compounds could be generated and published, which assuming it would be within the level of skill in the art to make them, would bar a patent to the actual discoveries of a named compound no matter how beneficial to mankind it might be. In re Wiggins, 488 F.2d 538, 543 179 USPQ 421, (CCPA 1973).

Anticipation cannot be predicated as in the present case on teachings in a reference that are vague or based on conjecture. Datascope Corp. v. SMEC Inc., 224 USPQ 694, 698 (D. N.J. 1984), aff'd in part, rev'd in part, 776 F.2d 320, 227 USPQ 838 (Fed. Cir. 1985).

Thus, Kroto, et al. is non-enabling and its citation is improper. Consequently, the rejection of the claims under

35 U.S.C. §102(b) is improper and withdrawal thereof is respectfully requested.

Furthermore, even assuming, pro arguendo, that Kroto, et al. does teach the preparation of a C₆₀ (or C₇₀), it was never formed in appreciable amounts. They never prepared solid or crystalline C₆₀ or C₇₀, as presently claimed. It was not possible to prepare the solid or, for that matter, C₆₀ or C₇₀, in any appreciable amounts, without undue experimentation. As stated in Curl et al., despite extensive efforts by the scientific community, no one was successful in preparing C₆₀ or C₇₀ in any appreciable amounts.

Consequently, Kroto, et al., do not teach, or disclose solid C₆₀, or solid C₇₀, crystalline C₆₀, crystalline C₇₀, solids consisting essentially of C₆₀, C₇₀, etc, or any matter coated with solid C₆₀ or C₇₀ as presently claimed. Furthermore, contrary to the allegations of the Examiner, there is direct evidence that the material produced by Kroto, et al., is different from that produced by the present invention. When Kroto, et al., collected the sooty carbon produced by the vaporization laser, and slurried the soot in benzene they did not obtain colored solution, which they should have, if C₆₀ were present. On the contrary, they obtained a clear solution. See Curl, et al., p55. On the other hand, the present inventors obtained a colored solution when benzene was added to their soot. See Example 1. Thus, the material obtained by Kroto, et al., was different from that obtained by the process of the present invention. Therefore, for the reasons given herein, the claimed invention is not anticipated by Kroto, et al. Consequently, for another reason, the rejection of the claims under 35 U.S.C. §102 is overcome and withdrawal therefore is respectfully requested.

In support of its rejection of Claims 14-25, 27-31 and 33-36, the Examiner cites Kirk-Othmer in view of Gerhardt, et al., Howard, et al. and Curl, et al.

Kirk-Othmer discloses the preparation of acetylene black and channel black. Acetylene black is prepared by burning acetylene and air to heat the metal retorts to reaction temperature, followed by shutting off the air supply to allow the acetylene to decompose to carbon and hydrogen in the absence of air. The high carbon concentration, high reaction time and relatively long residence time produce this acetylene black. Channel black comes from the use of still channel irons whose flat side was used to collect carbon black deposited from many small flames in contact with its surface.

Kirk-Othmer does not teach, disclose or even suggest C_{60} and C_{70} ; it doesn't even contemplate or discuss C_{60} or C_{70} . Consequently, Kirk-Othmer does not anticipate or render obvious the present invention. The Examiner appears to cite Gerhardt, et al., Howard, et al. and Curl, et al. to show that C_{60} and C_{70} fullerenes are inherently produced in the carbon black processes described by Kirk-Othmer.

However, there is no suggestion on teaching in Kirk-Othmer that there is any relationship between the acetylene black or the channel black and the material described in the secondary references. There is no suggestion to combine the references, as the Examiner has done or that the acetylene black or the channel black is the material produced in the other cited references. In fact, neither Curl, et al. nor Howard, et al. discuss or disclose an acetylene flame. Thus, there is no thread linking Kirk-Othmer with Curl, et al. and Howard, et al. (Furthermore, their publication dates are subsequent to the filing date of the application and their use is limited.) Gerhardt, et al. disclose and talk about an

acetylene flame, but as indicated hereinabove, there is nothing in either Kirk-Othmer and Gerhardt, et al. to suggest that the material described in Kirk-Othmer is the same as that discussed in Gerhardt, et al. Furthermore, Gerhardt, et al., never isolated any C₆₀ or C₇₀ molecule. They separated material having the same m/e values as C₆₀ or C₇₀ by ionizing the molecules in a mass spectrophotomer but they detected only the molecular ions. As discussed hereinabove, respecting Kroto, et al., they had no direct evidence of the existence of C₆₀ or C₇₀. Their discussions to same are purely speculative and theoretical.

Thus, Kirk-Othmer alone or in contemplation of the other references, is not enabling to one skilled in the art with respect to C₆₀ and C₇₀. In order to be enabling, the 35 U.S.C. §102(b) reference must place the public in possession of it. In re Donahue. The same is true if a reference is cited under 35 U.S.C. §103. Beckman Instruments Inc. LKB Produkter AB, 892 F.2d 1547, 13 USPQ 2d 1301 (Fed. Cir. 1989). In order to render the invention unpatentable under 35 U.S.C. §102 or §103, the prior art must enable one skilled in the art to make it. See, Donahue, Beckman Instruments. This, the cited art failed to do. Nowhere does Kirk-Othmer discuss C₆₀ or C₇₀; it was not even contemplated or suggested therein. The secondary references do not disclose or teach any method of preparing the same. Gerhardt, et al. do not teach, disclose or suggest a method of isolating C₆₀ molecules or C₇₀ molecules; at best, they only detect molecular ions having m/e values of C₆₀ and C₇₀. As described hereinabove, in the discussions of Curl, et al., until the present inventors developed the present invention, the skilled artisan could not prepare quantities of C₆₀ and C₇₀. Furthermore, the references do not teach, disclose or even suggest how to

isolate the same. Thus, the references are non-enabling and are improperly cited under 35 U.S.C. §102 and 103.

Furthermore, assuming that Kirk-Othmer can be combined with Gerhardt, et al., as the Examiner has alleged, there is no evidence that the acetylene black or channel black process contains any C₆₀ or C₇₀. The acetylene black or channel black contain the black soot outside of the flame, whereas, Gerhardt, et al., speculate that the carbon may be present in the flame. Consequently, based on the teachings carbon black and the channel black do not have C₆₀ or C₇₀. The references do not teach or disclose any solid C₆₀ or solid C₇₀ or crystalline C₆₀ or crystalline C₇₀ or any solid containing solid C₆₀ or solid C₇₀, or solids containing some or any of the other subject matter applicants have claimed. Consequently, assuming the Examiner is correct, the rejection under 35 U.S.C. §102 is overcome and withdrawal is respectfully requested.

Moreover, had fullerenes been found outside the flame, as the Examiner had suggested, it certainly would have served as a basis for scientists, such as Curl, et al., to produce fullerenes as there was an active effort to do so. However Curl, et al. were not able to make C₆₀ with the Gerhardt information:

Even though some theorists had argued that theorists had argued that this hollow, soccer ball-shaped molecule should be detectable in abundance in such every day circumstances, as a bundle flame, the German-American team had actually found it succeeding where all others had failed.

Curl, et al. p. 55.

Thus, the present inventors had fulfilled a long felt demand, which is cogent evidence of its unobviousness. In re Dow Chemical Company, 837, F.2d. 469, 5 USPQ 2d 1529 (Fed. Cir. 1988).

Thus, for the reasons given hereinabove, the rejection of the claims under 35 U.S.C. §102 or in the alternative under 35 U.S.C. §103 as defining subject matter which is allegedly anticipated or rendered obvious by Kirk-Othmer in view of Gerhardt, et al., Curl, et al. and Johnson, et al. is overcome and withdrawal thereof is respectfully requested.

Therefore in view of the Amendments to the claims and the Remarks hereinabove, it is respectfully requested that the present case is in condition for allowance, which action is earnestly solicited.

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